EE/CprE/SE 491 - sddec22-13
Simultaneous Call Transmission (SCT)
Week 4

February 21st, 2022 - February 27th, 2022
Client: Collins Aerospace
Faculty Advisor: Dr. Andrew Bolstad

Team Members

- Hani El-Zein - *Digital Signal Processing Lead and Research*
- Sullivan Jahnke - *Project Manager and Lead Communicator*
- Tyler Mork - *Reports, Research, and Communications System Co-Lead*
- Json Rangel - *Communicator and Communications System Co-Lead*
- Austin Rognes - *Research and MATLAB Lead*

Week 4 Summary

This week's progression was further implementing our simulated problem within Matlab to that of a real world event. We were adamant about getting this correct as to identify methods to detect the various transmission calls on whatever channel it may be. Furthermore, time was invested into investigating efficient ways of manipulating an incoming signal to detect two or more carrier frequencies. As we understand it now, with real world error included, a simultaneous call transmission cannot occur at the exact same frequency within a channel and the exact same power magnitude on a frequency spectrum. The probability of this event would be very unlikely due to offsets in transmitted signals as well as a Best Signal Selector feature within the receiver.

Besides the continuation of the simulated SCT, our group became aware of the need for specifications relative to our algorithm and any corresponding hardware. We realized that certain requirements will need to be met for given conditions (ie. processing speed, percent error, mathematical operators and filtering cost, maximum and minimum frequency detection within a channel, maximum and minimum signal strengths, etc.)

Lastly, ground was made on researching machine learning concepts. We developed a simple machine learning program in java using youtube videos as a basis. We hope to be able to apply these concepts to when it is time to begin developing the first draft of the algorithm.

Past Week Accomplishments

Much of our accomplishments surfaced within our meeting with Collins this week. We had come to a common ground on the timeline prediction of our project throughout the course of the semester as well as a general inquiry on progression throughout the summer. There were also a multitude of technical questions regarding real world data

and physical hardware where many of them were discussed and answered in detail. It helped to alleviate some, if not most, of the confusion associated with the industry equipment and expected simulation results.

Lastly, as stated in the summary a simple java program was created that shows some of the machine learning concepts that we have researched in a real development context. Although it is in an entirely different programming language than what the actual algorithm will be implemented in, the concepts will be easy to translate from the code.

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Hani El-Zein	Unknown	Unknown	8.5
Sullivan Jahnke	Watching Youtube videos on ML, created simple java program to see these concepts in a real program	3	12.5
Tyler Mork	Continued research into simulation of SCT event as well as event detection manipulations	3	13
Json Rangel	Assistance with AM Simulink System, further communication systems research, and website design.	5.5	15.5
Austin Rognes	Learning ML through online classes. Group work/understanding the problem better	3	12

Plans for Upcoming Week

Further plans for this project are to get multiple case studies setup for an SCT event where simulations consist of real world factors such as the difference in carrier frequency offsets and signal power at the receiver. These factors are influenced by aircraft distance, buildings in the direct line of transmission, noise, transmission and receiver error, receiver hardware/software configurations, etc.

More research is needed to determine the frequency spectrum as well as the required signal transformations to successfully detect an SCT event. Efficiency and hardware implementation will need to be thought of in advance to optimize cost and physical bulk of the radio. As far as we know, aircraft channel frequencies vary greatly with narrow windows in between each channel by magnitudes of ~25 kHz; it brings into question the sensitivity of the SCT detection and how it will be expected to perform in an ATC setting. We have another bi-weekly meeting with Dr. Bolstad to discuss further into project details.

We will be further researching machine learning algorithms to begin attempting to write MATLAB code. More emphasis will be placed on deciding what Supervised machine learning technique(s) to use as well as how they will be implemented (ie. What kind of input data, what kind of output data, what features should be extracted, automation, etc.) It may prove easier to implement all filtering and mathematical operations through code functions rather than Simulink.